

## Claims

- [c1] A method of fabricating a MIM capacitor on a semiconductor wafer comprising depositing semi-transparent metal layers for top and bottom electrodes of said MIM capacitor.
- [c2] The method of claim 1 wherein said metal layers comprise a low resistance, high transmittance metal.
- [c3] The method of claim 1 wherein said semi-transparent metal layers are at least transparent in a portion of the visible spectrum.
- [c4] The method of claim 1 wherein said semi-transparent metal layers comprise indium-tin-oxide.
- [c5] The method of claim 1 further comprising:
  - depositing a layer of dielectric material between said semi-transparent metal layers;
  - patterning and etching said top and bottom electrodes from said dielectric material and said semi-transparent metal layers, such that said bottom electrode aligns to a previous metal interconnect layer;
  - depositing an interlayer dielectric over said top and bottom electrodes;

forming lines through said interlayer dielectric to said top and bottom electrodes; and  
depositing a metal liner and metal fill in said lines.

[c6] The method of claim 5 further comprising planarizing said interlayer dielectric.

[c7] The method of claim 5 further comprising chemical-mechanical polishing said MIM capacitor after depositing said metal liner and metal fill.

[c8] A method of fabricating a MIM capacitor on a semiconductor wafer having an insulating layer thereon, said method comprising:  
depositing alternate layers of a dielectric material and a semi-transparent metal on said insulating layer;  
patterning and etching said dielectric layer and said semi-transparent metal layer to form a top electrode;  
patterning and etching said capacitor dielectric layer and said semi-transparent metal layer to form a bottom electrode, such that said bottom electrode aligns to a previous metal interconnect layer;  
depositing an oxide interlayer dielectric over said top and bottom electrodes;  
patterning and etching said oxide interlayer dielectric to form lines to said top and bottom electrodes; and  
depositing a metal liner and metal fill in said lines.

- [c9] The method of claim 8 wherein said semi-transparent metal comprises a low resistance, high transmittance metal, at least semi-transparent in a portion of the visible spectrum.
- [c10] The method of claim 8 wherein said semi-transparent metal comprises indium-tin-oxide.
- [c11] The method of claim 8 wherein said capacitor dielectric comprises  $\text{SiN}_x$ .
- [c12] The method of claim 8 further comprising planarizing said interlayer dielectric after depositing said interlayer dielectric.
- [c13] The method of claim 8 further comprising removing excessive conductive material by chemical-mechanical polishing after depositing said metal liner and metal fill deposition.
- [c14] The method of claim 8 wherein said patterning comprises applying a photoresist mask and developing said mask with ultraviolet light.
- [c15] The method of claim 8 wherein said etching comprises performing reactive ion etching.
- [c16] The method of claim 10 further comprising indium-

tin-oxide metal having a resistivity in the range of 230  $\mu\text{ohm-cm}$  after exposure to an annealing temperature of approximately  $250^{\circ}\text{C}$  in a  $\text{N}_2\text{H}_2$  atmosphere.

- [c17] A method of fabricating a thin film resistor on a semi-conductor wafer comprising depositing semi-transparent resistor material to eliminate a mask alignment process step.
- [c18] The method of claim 17 wherein said semi-transparent resistor material is indium-tin-oxide, or other metallic material at least transparent in a portion of the visible spectrum.
- [c19] The method of claim 17 further comprising:  
depositing a  $\text{SiN}_x$  cap layer over said interconnect copper layer;  
depositing a layer of semi-transparent resistor material over said  $\text{SiN}_x$  cap; and  
patterning and etching said semi-transparent resistor material with a photoresist mask, such that said resistor material aligns to said interconnect copper layer.
- [c20] The method of claim 19 wherein said resistor material is indium-tin-oxide, or other metallic material at least transparent in a portion of the visible spectrum.